REMARKS

This amendment is in response to a non-final Office action (Paper No. 7) dated March 28, 2002. Upon entry of this amendment, claims 1-10, 15-19 and 23-35 will be pending in this application. Applicants have amended claims 1, 15, 26, 29 and 32 and have newly added claim 35 and have canceled claims 20-22 without prejudice or disclaimer as to their subject matter by this amendment.

The Examiner objected to claims 1, 15 and 22 for minor informalities. Applicants have amended claims 1 and 15 to overcome these objections. Claim 22 has been canceled making this objection moot.

The Examiner has rejected claims 26-34 under 35 U.S.C. § 112, first paragraph because the specification lacks a teaching of the method claimed in depending claims 26-34. Applicants have amended the specification to include a description of the method for manufacturing the printheads of the present invention. No new matter has been added as the specification has been amended only to describe the process of claims 23-25 that are found in the originally filed application.

The Examiner has rejected claims 6 and 26-34 under 35 U.S.C. § 112, second paragraph. Applicants traverse the rejection of claim 6 because Applicants submit the term "chamber orifice" is claimed in claim 2.

Regarding the rejection of claims 26-34, Applicants have amended claims 26, 29 and 32 to overcome the rejection.

The Examiner has rejected claims 1, 2, 4-8, 15-17 and 19-22 under 35 U.S.C. § 102 (e) as being anticipated by Weber *et al.,* U.S. Patent No. 6,003,977. The Examiner has rejected claims 3 and 18 under 35 U.S.C. § 103 (a) as being unpatentable over Weber '977 in view of Abe *et al.,* U.S. Patent No. 4,914,562. The Examiner has rejected claims 9 and 10 under 35 U.S.C. § 103 (a) as being unpatentable over Weber '977 in view of Heinzl *et al.,* U.S. Patent No. 5,760,804. Applicants have amended independent claims 1 and 15 to overcome these rejections.

Applicants have amended claim 1 to claim that the substrate is a single integrated monolithic unit made of a homogenous substance being Silicon. Applicants submit that Weber '977 has substrate 23 wherein the ink feed channels and the ink feed holes are found therein. However, substrate 23 in Weber '977 comprises a silicon base 24 where the ink feed grooves are formed therein and support layer 25 where the ink feed holes are found therein. Support layer 25 in Weber '977 is formed of a different substance than silicon base 24. Support layer 25 can be either silicon dioxide, silicon nitride, silicon carbide, tantalum, polysilicon glass such that support layer 25 has a different etchant sensitivity than silicon base 24. Applicants submit that Applicants structure is advantageous in that Applicants' structure does not require application of the extra layer 25 to form both the grooves and the ink feed holes. Also, Applicants' structure is different in that the same material is etched to form both the ink feed holes and the grooves.

Applicants submit that Weber '977 teaches away from Applicants' structure and process by having two separate materials, one to form the ink grooves and another to form the ink feed holes. Applicants have amended independent claim 1 to claim this feature.

Applicants submit that the Applicants third embodiment as depicted by FIG. 21 is further distinguished from the applied prior art. In Applicants' third embodiment, the lower portion of the nozzle holes are cylindrical as opposed to frustum-shaped. Applicants submit that this feature is neither taught nor suggested by the applied prior art. Applicants have amended independent claim 15 to claim this novel feature.

Applicants further submit that the feature of having the lower portion of the nozzle hole being cylindrical and not frustum-shaped was previously claimed in Applicants' claim 22. Applicants submit that the Examiner never mentioned the subject matter of claim 22, including the cylindrical portion of the nozzle hole in Paper No. 7. Therefore, Applicants submit that the Examiner never fully examined former claim 22 in Paper No. 7. Applicants submit therefore that Paper No. 7 was an incomplete examination on the merits and respectfully request that the Examiner not make the next Office action final. This important feature of former claim 22 has been incorporated into independent claim 15 by this amendment. Applicants submit that the Applicants deserve an examination of the cylindrical portion of the nozzle hole feature prior to finalizing prosecution.

Applicants further submit the cylindrical section 21b' of each nozzle hole 21' provides expanded volume in nozzle hole 21; thus providing expanded space for bubble formation as cylindrical section 21b' is adjacent to the heater. Applicants submit that this feature is neither taught nor suggested by the applied prior art. Applicants also submit that having cylindrical section 21b' in nozzle hole 21' is also advantageous over Applicants' other embodiments and the applied prior art. Examination is respectfully requested.

No fees are incurred by the filing of this Amendment.

In view of the above, all claims are deemed to be allowable and this application is believed to be in condition to be passed to issue. Should any questions remain unresolved, the Examiner is requested to telephone Applicant's attorney.

Respectfully submitted,

Robert E. Bushnell,
Attorney for the Applicant
Registration No.: 27,774

1522 "K" Street N.W., Suite 300
Washington, D.C. 20005
(202) 408-9040

Folio: P56310
Date: 6/24/02
I.D.: REB/ML

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please cancel claims 20-22 without prejudice or disclaimer as to their subject matter, and amend claims 1, 15, 26, 29 and 32, as follows, and newly add claim 35 as set forth above:

1. (Amended) An ink-jet printhead, comprising:

a substrate being a single integrated monolithic and homogenous unit of silicon, said substrate, having a rear surface, said rear surface having a channel having a predetermined depth, wherein a plurality of ink feed holes are formed on a bottom of the channel perforating said substrate;

a nozzle plate coupled to a front surface of the substrate, said nozzle plate being perforated by a plurality of chamber-orifice complex holes, wherein each chamber-orifice complex hole corresponds to at least one of said plurality ink feed holes; and

a plurality of heaters disposed on the front surface of the substrate, each one of said plurality of heaters being located near corresponding ones of said plurality of chamber-orifice complex holes.

15. (Amended) An ink-jet printhead, comprising:

a substrate having a front side and a back side opposite to said front side, wherein said back [said] side comprises a channel along an entire length of said substrate, said channel having a bottom wherein a plurality of holes perforate through to said front side of said substrate;

a plurality of heaters, each electrically connected to a pair of signal lines, disposed on said front side of said substrate, each one of said plurality of heaters being located near at least one of said plurality of holes in said substrate; and

a nozzle plate perforated by a plurality of nozzle holes, said nozzle plate [being] having a bottom side attached to said front side of said substrate so that each one of said plurality of nozzle holes exposes corresponding ones of said plurality of heaters and so that each one of said plurality of nozzle holes exposes at least one of said plurality of holes perforating said substrate, each of said plurality of nozzle holes having a conical, frustum-shaped section and a cylindrical section, said frustum-shaped section being at a top side of said nozzle plate and said cylindrical section being near said bottom side of said nozzle plate, each of said plurality of nozzle holes having a first diameter at said top side of said substrate and a second and larger diameter on said bottom side of said substrate, said frustum-shaped section of each nozzle hole joining with said cylindrical section of each nozzle hole at a location between said top side and said bottom side of said nozzle plate and at a point where a diameter of said nozzle plate is equal to said second diameter.

26. (Amended) The ink-jet printhead of claim 1, said ink-jet printhead being [mass] manufactured by a process geared for mass production, said process comprising the steps of:

etching said channel into a rear surface of said substrate;

etching a plurality of holes through to said front surface of said substrate to perforate said substrate;

depositing a first plurality of signal lines and a second plurality of signal lines on said front surface of said substrate, each one of said first plurality of signal lines terminating near termination points of corresponding ones of said second plurality of signal lines, each of said terminating portions of said first and said second signal lines terminating near at least one of said plurality of holes perforating said front surface of said substrate;

depositing said heaters made of a resistive material onto said front surface of said substrate so as to said connect terminating ends of each one of said first plurality of signal lines with corresponding terminating ends of said second plurality of signal lines, said resistive material being near to at least one of said plurality of holes perforating said front surface of said substrate; and

attaching said nozzle plate perforated by said plurality of nozzle holes onto said front surface of said substrate so that each one of said plurality of nozzle holes is aligned to corresponding ones of terminating ends of said first and said second signal lines, said resistive material, and at least one of said plurality of holes perforating said front surface of said substrate.

29. (Amended) The ink-jet printhead of claim 17, said ink-jet printhead being [mass] manufactured by a process geared for mass production, said process comprising the steps of:

etching said channel into said back side of said substrate;

etching said substrate to produce said plurality of holes that perforate said front side of said substrate;

depositing a first plurality of signal lines and a second plurality of signal lines on said

front surface of said substrate, each one of said first plurality of signal lines terminating near termination points of corresponding ones of said second plurality of signal lines, each of said terminating portions of said first and said second signal lines terminating near at least one of said plurality of holes perforating said front side of said substrate;

depositing said plurality of heaters made of a resistive material onto said front surface of said substrate so as to said connect terminating ends of each one of said first plurality of signal lines with corresponding terminating ends of said second plurality of signal lines, said resistive material being near to at least one of said plurality of holes perforating said front side of said substrate; and

attaching said nozzle plate perforated by said plurality of nozzle holes onto said front side of said substrate so that each one of said plurality of nozzle holes are aligned to corresponding ones of terminating ends of said first and said second signal lines, said resistive material, and at least one of said plurality of holes perforating said front side of said substrate.

32. (Amended) The ink-jet printhead of claim 19, said ink-jet printhead being [mass] manufactured by a process geared for mass production, said process comprising the steps of:

etching said channel into said back side of said substrate;

etching said substrate to produce said plurality of holes that perforate said front side of said substrate;

depositing a first plurality of signal lines and a second plurality of signal lines on said front surface of said substrate, each one of said first plurality of signal lines terminating near

termination points of corresponding ones of said second plurality of signal lines, each of said terminating portions of said first and said second signal lines terminating near at least one of said plurality of holes perforating said front side of said substrate;

depositing said plurality of heaters made of a resistive material onto said front surface of said substrate so as to said connect terminating ends of each one of said first plurality of signal lines with corresponding terminating ends of said second plurality of signal lines, said resistive material being near to at least one of said plurality of holes perforating said front side of said substrate; and

attaching said bottom side of said nozzle plate perforated by said plurality of nozzle holes onto said front side of said substrate so that each one of said plurality of nozzle holes are aligned to corresponding ones of terminating ends of said first and said second signal lines, said resistive material, and at least one of said plurality of holes perforating said front side of said substrate.